Cardio Menu
Service Manual
Parts List

AT-1

3-Channel Electrocardiograph

Welch Allyn®
Schiller®

AT-1 User Guide

Article Number 2. 510270b

Associated Documents

Physician`s Guide to the Interpretation and Measurement Program
Article Number 2. 510 179

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DECLARATION OF CONFORMITY

Electrocardiograph:	**AT-1**
Serial numbers starting with:	190.00100
Year of manufacture:	1995 Onwards

We, the undersigned, hereby declare that the medical device (class IIa) specified above conforms with the essential requirement listed in Annex 1 of EC Directive 93/42/EEC.

This declaration is supported by:
Certificate of approval No:

11425-02	ISO 9001 / EN 46001 by SQS valid date 17. January 2001
45112-60-01	ISO 9001/ 07.94, EN 46001 / 08.96 by DEKRA valid date 30.04.2003
and	
45112-16-01	Annex II, Section 3 of the Directive 93/42/EEC, valid date 30.04.2003

CE 0124

Baar (Switzerland) 06.05.1998

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Terms of Warranty

WELCH ALLYN SCHILLER warrants the AT-1 Electrocardiograph, when new, to be free of defects in material and workmanship and to perform in accordance with manufacturer`s specifications for the period of three (3) years from the date of purchase from Welch Allyn or it`s authorized distributors or agents. Accessory items such as electrodes, batteries and cables are limited to a warranty of 90 days from the date of purchase from Welch Allyn or its authorized distributors or agents. Welch Allyn will repair or replace any components found to be defective or at variance from manufacturer`s specifications within this time at no cost to the customer. It shall be the purchasers responsibility to return the instrument to Welch Allyn or an authorized distributer, agent or service representative. This warranty does not include breakage or failure due to tampering, misuse, neglect, accidents, modifications or shipping. This warranty is also void if the instrument is not used in accordance with manufacturer`s recommendations or if repaired by other than Welch Ally or an authorized agent. Purchase date determines warranty requirements. No other express warranty is given.

PHYSICIAN‘S RESPONSIBILITY

THE AT-1 ELECTROCARDIOGRAPH IS PROVIDED FOR THE EXCLUSIVE USE OF QUALIFIED PHYSICIANS OR PERSONNEL UNDER THEIR DIRECT SUPERVISION. THE NUMERICAL AND GRAPHICAL RESULTS FROM A RECORDING MUST BE EXAMINED WITH RESPECT TO THE PATIENTS OVERALL CLINICAL CONDITION. THE RECORDING PREPARATION QUALITY AND THE GENERAL RECORDED DATA QUALITY, WHICH COULD EFFECT THE REPORT DATA ACCURACY, MUST ALSO BE TAKEN INTO ACCOUNT.

IT IS THE PHYSICIANS RESPONSIBILITY TO MAKE THE DIAGNOSIS OR TO OBTAIN EXPERT OPINION ON THE RESULTS, AND TO INSTITUTE CORRECT TREATMENT IF INDICATED.

FEDERAL LAW IN THE USA RESTRICTS THIS DEVICE TO SALE BY OR ON THE ORDER OF A PHYSICIAN

Safety Notices

TO PREVENT ELECTRIC SHOCK DO NOT DISASSEMBLE THE UNIT. NO SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL ONLY.

DO NOT USE THIS UNIT IN AREAS WHERE THERE IS ANY DANGER OF EXPLOSION OR THE PRESENCE OF FLAMMABLE GASES SUCH AS ANAESTHETIC AGENTS.

THIS PRODUCT IS NOT DESIGNED FOR STERILE USE.

THIS PRODUCT IS NOT DESIGNED FOR OUTDOOR USE.

SWITCH THE UNIT OFF BEFORE CLEANING AND DISCONNECT FROM THE MAINS.

DO NOT, UNDER ANY CIRCUMSTANCES, IMMERSE THE UNIT OR CABLE ASSEMBLIES IN LIQUID.

THE DEVICE MUST ONLY BE OPERATED USING BATTERY POWER IF THE EARTH CONNECTION IS SUSPECT OR IF THE MAINS LEAD IS DAMAGED OR SUSPECTED OF BEING DAMAGED.

DO NOT USE HIGH TEMPERATURE STERILISATION PROCESSES (SUCH AS AUTOCLAVING). DO NOT USE E-BEAM OR GAMMA RADIATION STERILISATION.

DO NOT USE SOLVENT CLEANERS

USE ONLY ACCESSORIES AND OTHER PARTS RECOMMENDED OR SUPPLIED BY WELCH ALLYN SCHILLER. USE OF OTHER THAN RECOMMENDED OR SUPPLIED PARTS MAY RESULT IN INJURY INACCURATE INFORMATION AND/ OR DAMAGE TO THE UNIT.

THE AT-1 COMPLIES WITH EMC REGULATIONS FOR MEDICAL PRODUCTS WHICH AFFORDS PROTECTION AGAINST EMISSIONS AND ELECTRICAL INTERFERENCE. HOWEVER SPECIAL CARE MUST BE EXERCISED WHEN THE UNIT IS USED WITH HIGH FREQUENCY EQUIPMENT.

IT MUST BE ENSURED THAT NEITHER THE PATIENT NOR THE ELECTRODES (INCLUDING THE NEUTRAL ELECTRODE) COME INTO CONTACT WITH OTHER PERSONS OR CONDUCTING OBJECTS (EVEN IF THESE ARE EARTHED).

*THERE IS NO DANGER WHEN USING THE ECG UNIT FOR A **PACEMAKER PATIENT** OR WITH SIMULTANEOUS USE OF OTHER ELECTRICAL STIMULATION EQUIPMENT. HOWEVER, THE STIMULATION UNITS SHOULD ONLY BE USED AT A SUFFICIENT DISTANCE FROM THE ELECTRODES. IN CASE OF DOUBT, THE PATIENT SHOULD BE DISCONNECTED FROM THE RECORDER.*

THIS UNIT IS CF CLASSIFIED ACCORDING TO IEC 601-1. THIS MEANS THAT THE PATIENT CONNECTION IS FULLY ISOLATED AND DEFIBRILLATION PROTECTED. WELCH ALLYN SCHILLER CAN ONLY GUARANTEE PROTECTION AGAINST DEFIBRILLATION VOLTAGE HOWEVER, WHEN THE ORIGINAL WELCH ALLYN SCHILLER PATIENT CABLE IS USED.

IF SEVERAL UNITS ARE COUPLED THERE IS A DANGER OF SUMMATION OF LEAKAGE CURRENT

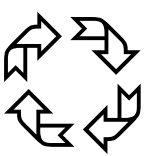
DO NOT TOUCH THE CASING DURING DEFIBRILLATION

IF THE PATIENT CABLE SHOULD BECOME DEFECTIVE AFTER DEFIBRILLATION, LEAD OFF WILL BE DISPLAYED AND AN ACOUSTIC ALARM GIVEN

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to both Part 15 of the FCC (Federal Communications Commision) Rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Disposal Instructions and Battery Care

- DO NOT DISPOSE OF THE BATTERY BY FIRE OR INCINERATOR - DANGER OF EXPLOSION
- DO NOT ATTEMPT TO RECHARGE THE BATTERY - DANGER OF EXPLOSION
- DO NOT OPEN THE BATTERY CASING - DANGER OF ACID BURN



Only dispose of the battery in official recycling centres or municipally approved areas. Alternatively used batteries can be returned to Schiller AG for disposal.

Unit Disposal Instructions

Units no longer required can be returned to Schiller AG for disposal. Alternatively dispose of the unit in municipally approved recycling centres.

Power Supply

The mains connection is on the rear of the unit.

The power supply voltage is set by the factory for100-115V(nom. 110V) or 220-240V (nom. 230V) working. The setting is indicated by the indented metal strip on the fuse panel. Contact your dealer if the voltage needs to be changed.

The mains indicator lamp on the keyboard is always lit when the unit is connected to the mains supply. The unit can either be operated from the mains supply or from the built-in rechargeable battery. The power source is indicted on the top line of the LCD.

Changing a Mains Fuse

If it is necessary to change a fuse, always replace with the correct rating i.e 2x200mAT for 230V, or 2x315mAT for 110V .

To change a fuse press the two retaining lugs on side of the fuse panel (situated below the mains connector on the back panel. Remove the fuse panel and replace the fuse(s). Click back the fuse panel.

AT-1 User`s Guide

This User`s Guide gives instructions on how to operate the unit and provides an overview of all the basic functions in an easy and simple to use format. The procedures are presented in a logical, step-by step way to enable the user to quickly and easily familiarise themselves with unit operation. Detailed medical information is excluded from this guide except where necessary to operate the unit or understand the results.

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CE 0124 93/42/EEC Medical Devices:
0124 `Notified Body` DEKRA AG

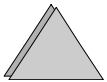
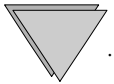
AT-1 - User Guide

Short Form Instructions

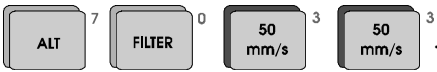
Automatic ECG Recording

- Prepare skin, hook up patient
- Press ON to switch unit on.
- Wait for at least 10 seconds for the ECG to stabilise.
- Press AUTO to record and print.
- Press COPY for additional copies.
- Press OFF to switch unit off.

Manual ECG Recording (Rhythm Strip)

- Prepare skin, hook up patient
- Press ON to switch unit on.
- Press MAN START to start printout.
- Change lead group with  and  .
- Press STOP to stop the printout.

Electrode hook-up check

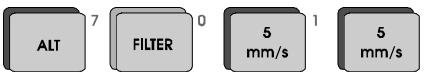
- Press key sequence  .

The contact resistance of each electrode is printed. Best results are obtained when the electrode voltage readings (right column) are between ±50mV.

Filter On/Off

- Press to switch the (Myogram) filter On / Off.

Print System Configuration

- Press key sequence  .

Short Form Instructions 1

Introduction 4
AT-1 - Operation Modes - Automatic 5
AT-1 - Operation Modes - Manual Mode 5

Patient Cable Connections 6
Standard Leads 7

Recording an ECG in Automatic Mode 8

Recording an ECG in Manual Mode 10
Acoustic QRS Indication 10

Location and Power Supply 12
Location 12
Power Supply 12

Switching the Unit On and Off 13
Switching On and Off 13
Potential Equalisation 13

Keyboard 14

Settings 17
Defaults 18
Printout of Current Settings 19
Select Language 20
Baseline Filter 21

Mains Filter *22*
Myogram Filter *23*
Lead Sequence (standard/Cabrera), Printout (simultaneous/ sequential) & Paper Settings *24*

Automatic Mode (ECG) Settings ***25***
ECG Format *25*
Average Cycles *26*
Measurements and Markings *27*
Rhythm Leads *28*
Patient Data Field *30*

Measurements ***31***
Heart Rate (HR) *31*
Intervals *31*
Electrical Axis *32*

Care & Maintenance ***37***
Care of your AT-1 ..... *37*
Self-test *37*
Maintenance *37*

Replacing the Recording Paper ***38***

Trouble Shooting ***39***

Technical Data ***40***

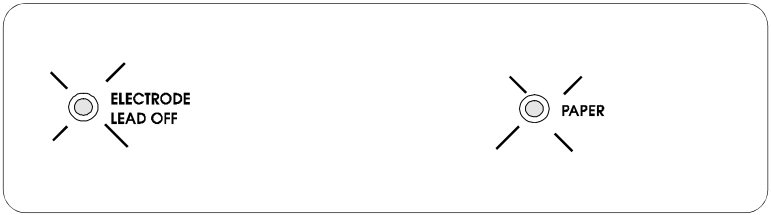
Introduction

The Welch Allyn Schiller AT-1 is a 3-channel ECG recorder with the following features:

- Low weight and compact dimensions.
- Built-in rechargeable battery for mains-independent use.
- Simple one key operation.
- Automatic or manual recording modes.
- Selectable printing formats with integrated quality thermal printer.
- ECG memory for easy copying.
- Choice of 8 languages for printing.

The unit receives and processes all ECG signals simultaneously and continuously records the data in a circular 10 second memory.

If there is any disturbance (i.e. loose electrode or end of paper), an audible alarm is given and the corresponding indicator lamp flashes, for example



As long as the disturbance remains, no ECG can be stored. As soon as the defect is eliminated, storage starts.

AT-1 - Operation Modes - Automatic

Automatic Mode provides a printout giving 10 seconds of ECG recording of all 12 leads in 2 different formats.

The following can be programmed freely in each of the formats before recording:

- Lead Format
- Chart Speed
- Measurements
- Average Cycles & Markings

For further information see Paragraph “ECG Recording in Automatic Mode”.

AT-1 - Operation Modes - Manual Mode

Manual Mode provides a real time printout of 3 leads that are selected and indicated on the keyboard.

The following can be freely selected before or during recording:

- Lead Group
- Chart Speed
- Sensitivity
- Myogram Filter

For further information see Paragraph “ECG Recording in Manual Mode”.

Patient Cable Connections

The accessory kit of the electrocardiograph includes a 10-lead patient cable. This cable is plugged into the patient cable socket on the right-hand side of the unit and secured with the two screws.

The AT-1 is CF rated. The patient connection is fully isolated and defibrillation protected. Protection against defibrillation voltage is however only ensured, if the original SCHILLER patient cable (Part-no. 2.400070 / USA: 2.400071) is used. Make sure that during ECG recording neither the patient nor the conducting parts of the patient connection or the electrodes (including the neutral electrode) come into contact with other persons or conducting objects (even if these are earthed).

The quality of the ECG is dependent on the preparation and the resistance between the skin and the electrode. To ensure a good quality ECG and minimise the skin/electrode resistance, remember the following points:

1. **Ensure that the patient is warm and relaxed.**
2. **Shave electrode area before cleaning.**
3. **Thoroughly clean the area with alcohol.**
4. **Place the** C4 **electrode first - in the fifth intercostal space on midclavicular line. Then place:**

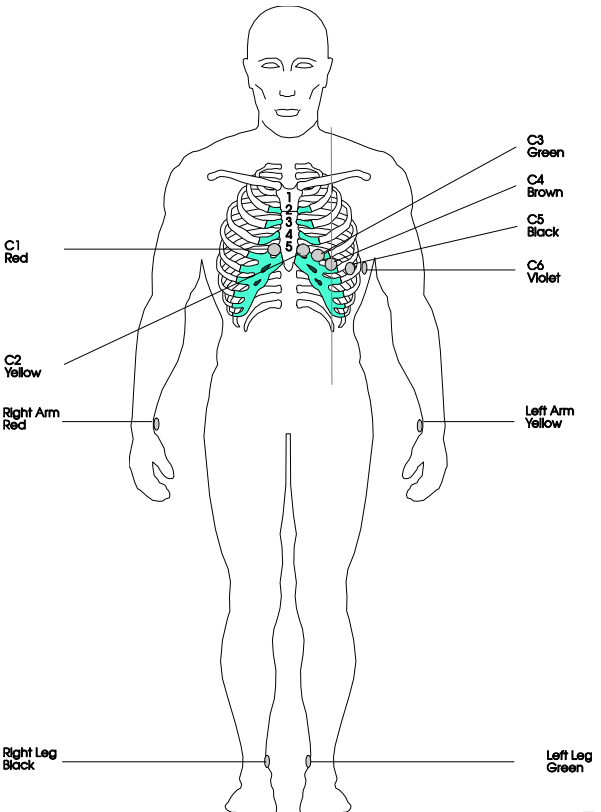
- C1 **in fourth intercostal space at the right sternal border**
- C2 **in fourth intercostal space at the left sternal border**
- C3 **between, and equidistant to, C4 and C2**
- C6 **on left midaxillary line on the same level as C4**
- C5 **between, and equidistant to, C4 and C6**

The electrode placements shown on the following page are labelled with the colors according to IEC requirements. The equivalent AHA colors are given on the table opposite.

Patient Cable Connections

IEC			AHA
N	Black	RL	Green
R	Red	RA	White
C1	White/Red	V1	Brown/Red
C2	White/Yellow	V2	Brown/Yellow
C3	White/Green	V3	Brown/Green
C4	White/Brown	V4	Brown/Blue
C5	White/Black	V5	Brown/Orange
C6	White/Violet	V6	Brown/Violet
L	Yellow	LA	Black
F	Green	LL	Red

Standard Leads



Recording an ECG in Automatic Mode

In **automatic mode**, a full 12-lead ECG is printed in one of two predefined formats with a sensitivity of 10 mm/mV. These two formats are selected by the user to suit his specific needs and requirements see ECG settings).

Pressing

before recording in automatic mode, the program detects very large waveform amplitudes and sets the sensitivity for the extremity and/or precordial leads to 5 mm/mV to reduce the overlapping of traces.

To start the automatic ECG recording in Format 1, press

.

To start the automatic recording in the second format, press

7 **followed by**

.

Recording an ECG in Automatic Mode

The printout provides the following information:

- ECG recording of all leads in either Standard or Cabrera format according to selection
- Sensitivity
- Heart Rate
- Speed

and if set:

- Data field to manually insert data
- Average Cycles
- Intervals
- Axis
- Detailed Measurement Table

To obtain an extra printout of the ECG recording in Format 1, press

.

To obtain an extra printout of the second format, press

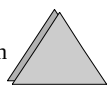
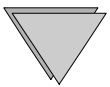
followed by

.

Recording an ECG in Manual Mode

Manual mode provides a direct printout of the real-time ECG with full control of parameter selection.

The following can be freely chosen during or before the recording:

Lead Group with  and 

The following lead groups are selectable:

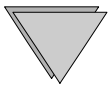
I II III
aVL I -aVR

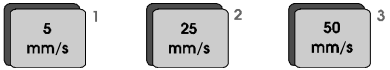
AVR aVL aVF
II aVF III

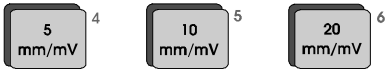
V1 V2 V3

V4 V5 V6

Additionally lead V1, II and V5 can be printed by pressing:

followed by 

Set Chart Speed 

Set Sensitivity 

Acoustic QRS Indication

The acoustic QRS indication can be switched on or off at any time by pressing the QRS BEEP key

.

Recording an ECG in Manual Mode

To start the manual printout, press

Stop the manual printout by pressing

The printout provides you with the following information:

- The group of the three selected leads with lead identification.
- On the lower edge chart speed, sensitivity and filter settings (if on) are given.
- At the top, the heart rate as current average of 4 beats is shown.

To re-centre the ECG traces, press the

key during operation.

.

Location and Power Supply

Location

Do not keep or operate the apparatus in a wet, moist, or dusty environment. Also, avoid exposure to direct sunlight or heat from other sources. Do not allow the unit to come into contact with acidic vapours or liquids, as such contact may cause irreparable damage. The unit should not be placed near X-ray or diathermy units, large transformers or motors.

The unit must be placed on a flat surface.

The unit should not be operated in areas where there is any danger of explosion.

Power Supply

The unit can either be operated from the built-in rechargeable battery, or from the mains.

The mains connection is on the rear of the unit.

The mains indicator lamp is always lit when the unit is connected to the mains supply.

A battery indicator lamp confirms battery operation. When the battery capacity is limited, the indicator flashes. To recharge the battery, connect the apparatus to the mains supply by means of the supplied power cable. A totally discharged battery needs less than 15 hours to be fully recharged (60% in less than 3 hours).

A fully charged battery lasts approximately 2 hours of normal use. The unit can remain connected to the mains supply without any danger of damage to either the battery or the unit.

Switching the Unit On and Off

Switching On and Off

The AT-1 is switched on by means of the green ON key

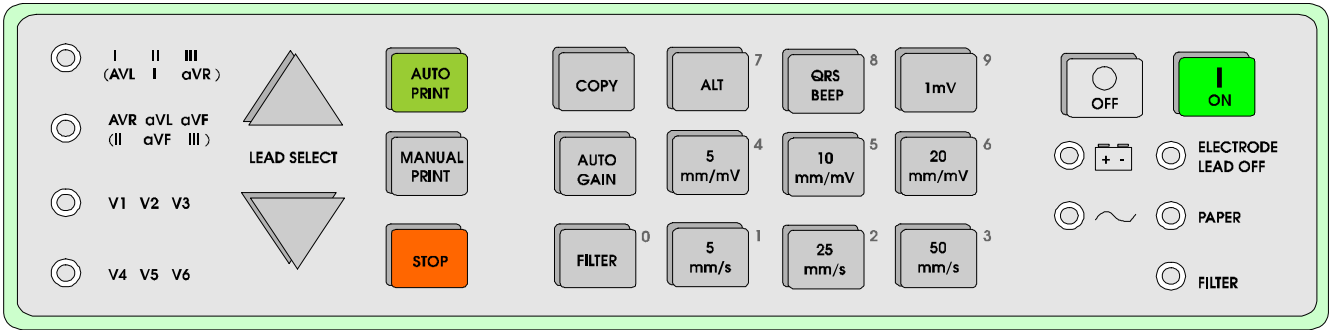
and off by means of the red OFF key

The unit is automatically switched off after 5 minutes (30 seconds if battery capacity is limited) if no key is pressed and the patient cable is not connected.

Potential Equalisation

If the AT-1 is used in conjunction with other (electrical) equipment connected to the patient, we recommend that the potential equalisation stud on the rear of the unit is connected to the practice / building common ground with the yellow/ green ground cable (Part-no. 2.310005).

Keyboard


I II III
(AVL I aVR)
AVR aVL aVF
(II aVF III)
V1 V2 V3
V4 V5 V6
LEAD SELECT
AUTO PRINT
MANUAL PRINT
STOP
COPY
ALT
7
QRS BEEP
8
1mV
9
AUTO GAIN
5 mm/mV
4
10 mm/mV
5
20 mm/mV
6
FILTER
0
5 mm/s
1
25 mm/s
2
50 mm/s
3
OFF
ON
+ -
ELECTRODE LEAD OFF
PAPER
FILTER

Keyboard

Switch unit on.

Switch unit off.

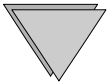
Copy stored ECG.

Start automatic recording.

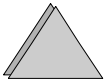
Start manual recording.

Stop recording.

Switch myogram filter (muscle tremor filter) on or off.



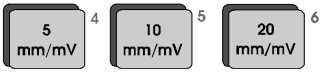
Lead group selector (forward).



Lead group selector (backward).

Cancel or enable QRS beeper.

Automatic ECG sensitivity adjustment from 10 to 5 mm/mV in order to avoid overlapping traces **in automatic mode only.**



ECG sensitivity
(5, 10 or 20 mm/mV).

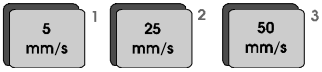


Chart speed
(5, 25 or 50 mm/s).

Note The speed and sensitivity keys are applicable for manual recording only.

Key for 1 mV indication mark on output during manual recording. Also recenters the trace during a manual printout.

Set second key function - key for initiation of setups and selection of second format for printout.

Keyboard

Mains indicator (lit when mains connected).

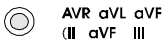
Battery lamp (lit when running on battery power - mains not connected) blinking when battery capacity is limited).

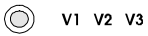
Warning lamp for end of paper or paper jam.

Warning lamp for loose electrode connection or poor electrode contact.

Myogram filter (lit when filter ON).

Indicator lamp for selected lead group (leads in brackets are Cabrera groups).





Lead Groups							
Standard				*Cabrera*			
I II III	aVR aVL aVF	V1 V2 V3	V4 V5 V6	*aVL* *I* *-aVR*	*II* *aVF* *III*	*V1* *V2* *V3*	*V4* *V5* *V6*

Note The lead group indicators are applicable for manual recording only.

Settings

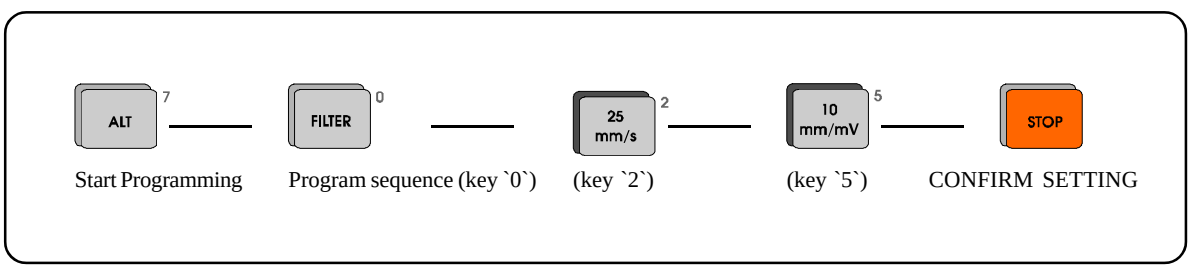
Each parameter is set by means of a code. This code comprises a combination starting with the **ALT** key followed by a number of keys and is always confirmed with the **STOP** key.

As soon as the **ALT** key is pressed, the keyboard is dedicated to the programming function.

The setting is remembered and the keyboard is only released for other functions when the **STOP** key is pressed. Once the settings have been confirmed, they are stored in the memory even when the unit is switched off.

As an example, if you want to set the language on the printout to American, proceed as follows:

With reference to the language table on page 20, press the following key sequence:



On the following pages the programmable parameters and the programming sequences are described in detail.

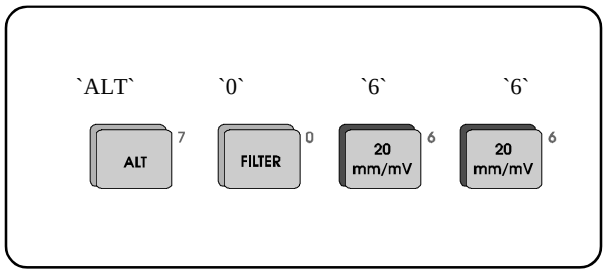
Settings

Defaults

The default settings are as follows:

Language	English
Leads	Standard (s)
Format 1	ECG: 25mm/s, Short (o) three pages
	MECG: 2*6 (50mm/s) + 1 Rhythm
	Measurements: Suppressed (-)
	Marks: Enabled (+)
Format 2	ECG: 25mm/s, long (ooo) six pages
	MECG: suppressed (-)
	Measurements: Suppressed (-)
	Marks: Enabled (+)
Rhythm Leads	V1, II
Auto Centering	Enabled (+)
Paper Type	Z- folded
Printout of Signals	Sequential
Baseline Filter Setting	0.05Hz
Mains Filter Setting	50Hz
Myogram Filter Setting:	35 Hz, OFF

To reset the unit to the default settings, press the following key sequence.

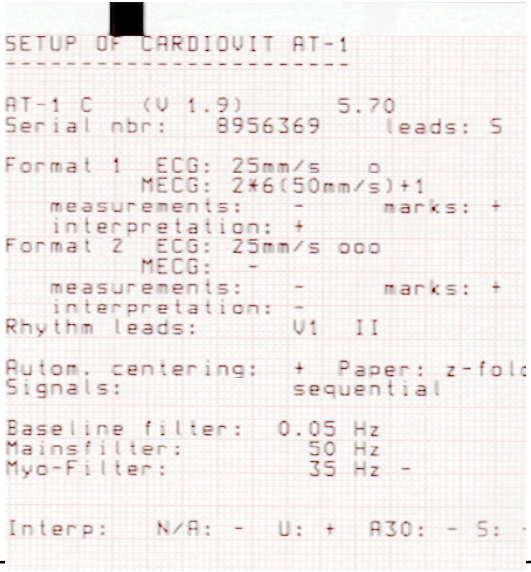


Printout of Current Settings

Obtain a printout of the formats and settings programmed by pressing the following key sequence:

A printout of the defined settings will be produced and gives the following information, depending on the installed software:

- Unit designation (AT-1) and Software version
- Serial number
- Leads: Standard (S) or Cabrera (C)
- ECG Format: Long (ooo), Short (o) or Suppressed (-)
- MECG: Average cycles as defined in auto ECG recording setup (e.g. 4 * 3 (25 mm/s))
- Measurements: Enabled (+) or Suppressed (-)
- Marks: Enabled (+) or Suppressed (-)
- Interpretation Enabled (+) or Suppressed (-)
- Selected Rhythm leads selected for R1, R2 resp.
- Automatic Centring: Enabled (+) or Suppressed (-)
- Paper Type: Z-Folded or Roll
- Printout of signals: Sequential or Simultaneous
- Baseline Filter: 0.05, 0.15 or 0.30 Hz
- Mains Filter: 50, 60 Hz or OFF (-)
- Myogram Filter: 25 or 35 Hz, ON (+) or OFF (-)
- Interpretation settings: N/A:+/- 'normal/abnormal' is written (+) or suppressed (-)
  U:+/- 'unconfirmed report' is written (+) or suppressed (-)
  A30:+/- patient age is assumed to be < 30 (-) or >30 (+)
  S: +/- low (-) or high (+) sensitivity



Select Language

Any of the following languages can be set for the printout.

Press the following key sequence:

`ALT`	`0`	`2`	then	key	`1`	for	German
					`2`		English
					`3`		French
					`4`		Swedish
					`5`		American
					`6`		Italian
					`7`		Spanish
					`8`		Portuguese
					`9`		Dutch
					`0`		Russian

Confirm the selection by pressing the **STOP** key

There are three different filters which can be set individually as follows:

- Baseline filter
- Mains filter
- Myogram filter

The setting for each filter is given on the setup printout (see Section “Maintenance” for details).

Baseline Filter

The digital **Baseline filter** suppresses excessive baseline drifts.

The setting options are as follows:

`ALT` `5`

then key `0` for 0.05Hz (default)
`1` 0.15Hz
`2` 0.30Hz

Confirm the selection by pressing the **STOP** key

The set value is the lower limit of the frequency range and is normally set to 0.05 Hz. The settings 0.15 and 0.30 Hz should only be used when absolutely necessary, as the possibility exists that they could affect the original ECG signal, especially the ST segments.

Mains Filter

The **Mains filter** is an adaptive digital interference filter designed to suppress AC interference without attenuating or distorting the ECG.

Select the mains frequency as follows:

Mains Filter				
Entry Key Sequence			*Filter Setting*	*Confirm*
ALT	8	5	Mains Filter 50 Hz	Press STOP Key
		6	Mains Filter 60 Hz	
		9	Mains Filter off	

Myogram Filter

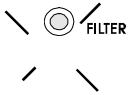
The **Myogram filter** suppresses disturbances caused by strong muscle tremor. The set value will be the new upper limit of the frequency range as soon as the **FILT** key is switched on or programmed as default when the unit is switched on. When the filter is active the **'FILT'** lamp on the unit is lit. Select the myogram filter settings as follows:

Myogram Filter				
Entry Key Sequence			*Setting*	*Confirm*
ALT	8	2	Myogram Filter 25 Hz	Press STOP Key
		3	Myogram Filter 35 Hz	
		1	Myo. Filt. ON when switching on unit (marked on printout with +)	
		8	Myo. Filt. OFF when switching on unit (marked on printout with –)	

The myogram filter is switched on and off manually with the **FILT** key

.

Following an auto mode recording, the ECG is stored unfiltered, it is therefore possible to print the stored ECG either with or without passing the myogram filter. Filter ON is indicated by the control lamp marked **'FILTER'**



When the **FILT** key is pressed again, the filter is switched off and the indicator lamp goes out. The cutoff frequency of the myogram filter is set to either 25 or 35 Hz.

Lead Sequence (standard/Cabrera), Printout (simultaneous/sequential) & Paper Settings

The required settings can be selected as follows:

Sequences, Print & Paper				
Entry Key Sequence			*Definition*	*Confirm*
ALT	7	1	Standard Lead Sequence	Press STOP Key
		2	Cabrera Lead Sequence	
		3	Simultaneous Print	
		4	Sequential Print	
		5	Auto-Centering ON	
		6	Auto-Centering OFF	
		7	Z-Fold Paper	
		8	Paper Roll	

The selectable printout forms are:

Simultaneous All 12 ECG leads are printed as 4 groups of 3 leads. All ECG leads are printed in the same time segment **(in automatic mode only)**.

Sequential All 12 ECG leads are printed as 4 groups of 3 leads. Each group is a contiguous time segment of approximately 2.5 or 5 seconds **(in automatic mode only)**.

Auto-Centering ON All ECG traces are centred dynamically for optimal use of paper width.

Auto-Centering OFF ECG traces are set to a fixed baseline position and may possibly overlap.

The selectable paper types are:

Z-folded Z-folded paper, 90 mm wide, with black marks

Roll Paper roll, 90 mm wide, without black marks (only offered in certain markets)

Automatic Mode (ECG) Settings

Two separate ECG auto mode formats can be defined.

To define auto mode format 1 the key sequence commences with `ALT followed by key `1`.

.

To define auto mode format 2 the key sequence commences with `ALT followed by key `2`.

.

The following pages give the auto mode settings.

ECG Format

The ECG format is set as follows:

ECG Format					
Entry Key Sequence				*Output Format*	*Confirm*
ALT	1 or 2	1	5	No leads are printed	Press STOP Key
			6	Leads are printed in short form (3 sheets)	
			7	Leads are printed in long form (6 sheets)	
			8	Chart speed is 25 mm/s	
			9	Chart speed is 50 mm/s	

Settings for Automatic Mode

Average Cycles

The Average cycles are defined as follows:

Average Cycles (Measurement Option only)					
Entry Key Sequence				*Output Format*	*Confirm*
ALT	1 or 2	2	5	No average cycles are printed.	Press STOP Key
			6	4 * 3 (25 mm/s) The average complexes are printed out in four groups of three leads at a chart speed of 25 mm/s.	
			7	4 * 3 (50 mm/s) The average complexes are printed out in four groups of three leads at a chart speed of 50 mm/s.	
			8	6 * 2 (50 mm/s) + 1 * Rhy The average complexes are printed out in six groups of two leads with one rhythm lead at a chart speed of 50 mm/s.	
			9	1 * 12 (25 mm/s) + 2 * Rhy The average complexes are printed out for all 12 leads individually with two rhythm leads at a chart speed of 25 mm/s.	

Note: Lead selection for the 2 rhythm leads are defined on the following page.

Measurements and Markings

To define the measurements and markings proceed as follows:

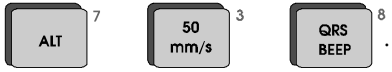
Measurements and Markings (Measurement Option only)					
Entry Key Sequence				*Output Format*	*Confirm*
ALT	1 or 2	3	5	Detailed table of measurement results is omitted (However, the values of electrical axes, intervals, and heart rate are not suppressed.).	Press STOP Key
			6	Detailed table of measurement results is printed.	
			7	Reference markings (beginning and end of P wave and QRS as well as end of T wave) are omitted.	
			8	Reference markings (beginning and end of P wave and QRS as well as end of T wave) are added to ECG cycles.	

Rhythm Leads

The rhythm leads are printed out in the last two average cycle selections (see previous page). Two separate rhythm leads can be selected. The following leads can be set:

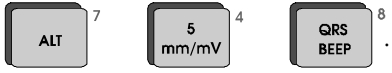
Extremity Leads

Rhythm Lead 1 (R1) press: `ALT` `3` `8`



.

Rhythm Lead 2 (R2) press: `ALT` `4` `8`



.

then key

`1`	for lead	I
`2`		II
`3`		III
`4`		aVR
`5`		aVL
`6`		aVF

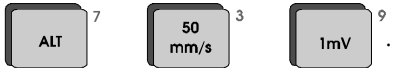
Confirm the selection by pressing the **STOP** key

.

Settings for Automatic Mode

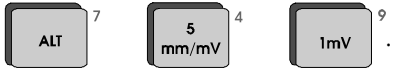
Extremity Leads

Rhythm Lead 1 (R1) press: `ALT` `3` `9`



.

Rhythm Lead 2 (R2) press: `ALT` `4` `9`



.

then key

`1`	for lead	V1
`2`		V2
`3`		V3
`4`		V4
`5`		V5
`6`		V6

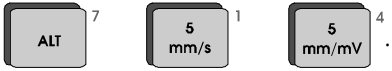
Confirm the selection by pressing the **STOP** key

.

Patient Data Field

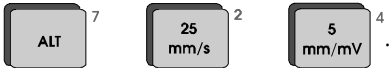
A patient data field can be included on the auto mode printout for manual insertion of name and age etc.

Auto Format 1 `ALT` `1` `4`



.

Auto Format 2 `ALT` `2` `4`



.

then

key `5`

Patient data field omitted.

`6`

Patient data field printed.

Confirm the selection by pressing the **STOP** key

.

Note: This section gives the measurements that are calculated by the AT-1 software.

Heart Rate (HR)

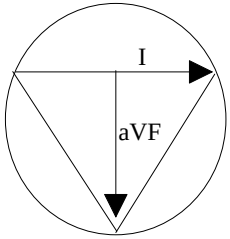
Average heart rate (**HR**) calculated on the basis of the entire 10 second recording and shown as number of beats per minute.

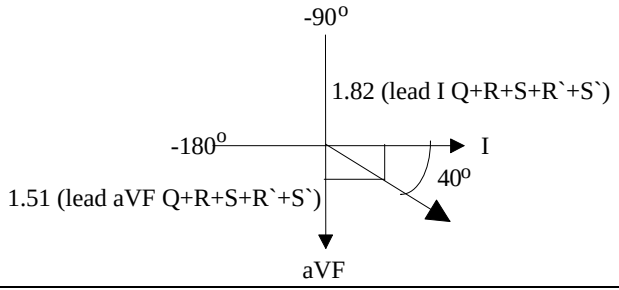
Intervals

Parameter	Description
RR	Average time interval between two consecutive QRS complexes.
P	Duration of the P wave (of averaged ECG complexes)
PQ	P-Q interval: the period of time between the beginning of the P wave and the beginning of the QRS complex (of averaged ECG complexes)
QRS	The duration of the QRS complex from the beginning of the Q wave to the end of the S wave (of averaged ECG complexes)
QT	Interval between the beginning of the QRS (beginning of ventricular depolarisation) and the end of the T wave (end of repolarisation phase) (of averaged ECG complexes)
QTC	Normalised QT interval. As the QT interval is dependent on the heart rate, it is often converted to the normalised QTC interval i.e. the QT the patient would show at a heart rate of 60 / min. Usually, the QTC amounts to 390 $\pm$ 40 ms. The conversion is according to Bazetts` formula : $QTC = QT \times \sqrt{\frac{1000}{RR}}$

Electrical Axis

The electrical axes of the heart are determined separately for the P, QRS and T waves. They indicate the main spreading direction of the electrical vector in the frontal plane.

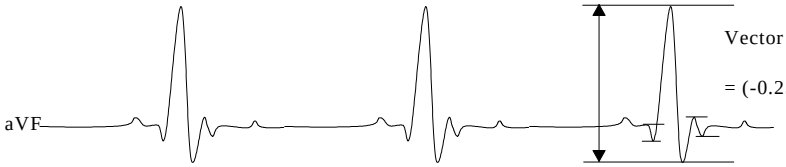




Measurements

Vector of lead I (Q, R, S and R', S')

= (-0.24Q) + 2.6R + (-0.55S) + 0.02R' + (-0.01S')



Vector of lead aVF (Q, R, S and R', S')

= (-0.25Q) + 2.41R + (-0.66S) + 0.02R' + (-0.01S')

The SCHILLER measurement program calculates the axes on the basis of the maximum deflection of the relevant waves in leads I and aVF. The following formula is used for the calculation:

$$\text{axis a} = \arctan\left(\frac{\text{Sum of max vector (aVF)}}{\text{Sum of max vector (I)}}\right)$$

on the example printout given this is:

$$\text{axis a} = \arctan\left(\frac{\sum Q + R + S + (R`+ S`)\,(AVF)}{\sum Q + R + S + (R`+ S`)\,(I)}\right)$$

$$\text{axis a} = \arctan\left(\frac{\sum (-0.25) + 2.41 + (-0.66) + 0.02 + (-0.01)}{\sum (-0.24) + 2.60 + (-0.55) + 0.02 + (-0.01)}\right)$$

$$\text{axis a} = \arctan\left(\frac{1.51}{1.82}\right) = 40^{o}$$

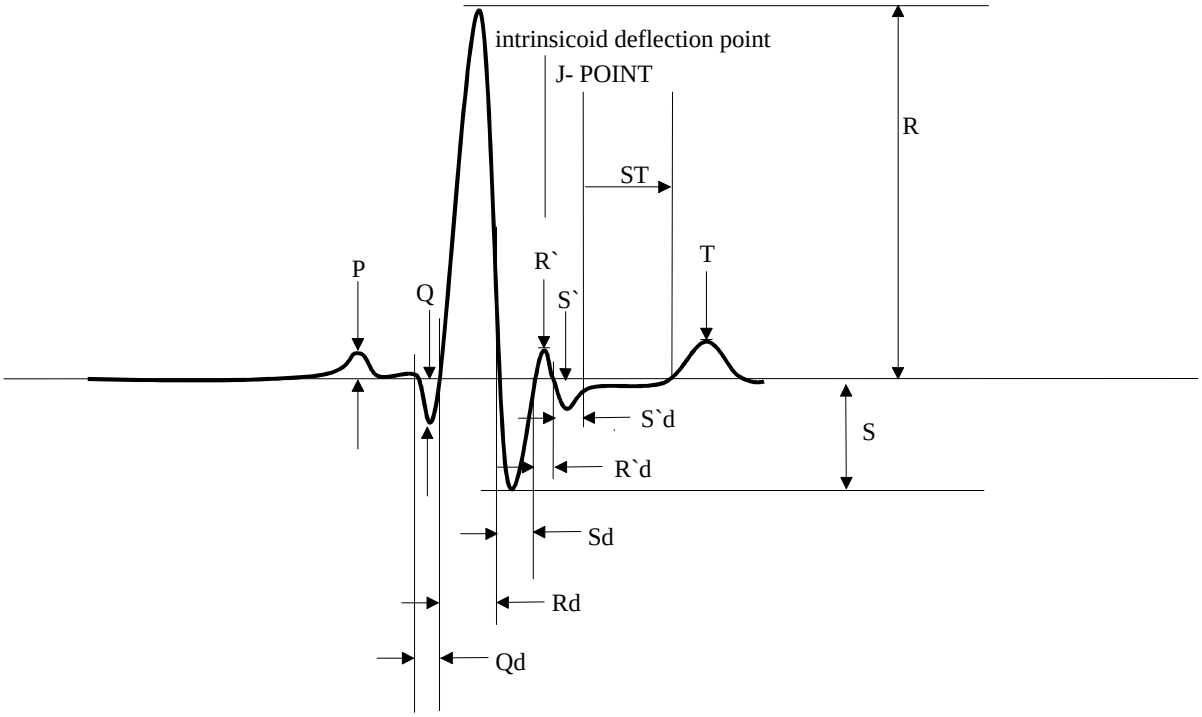
Note: Large discrepancies may be found between two measurements with faint P and T waves. Also breathing and the position of the patient (recumbent / standing) can result in changes in the electrical axes.

Measurements

The Schiller measurement program provides a table with lead specific measurement results. In 12 columns i.e. one for each lead, the amplitude values of P, Q, R ,S, T and R', S', T' waves, the J point and the ST integral are listed in millivolts. The amplitude measurements relate to a reference value that corresponds to the signal value immediately before the beginning of the QRS. For P measurement the zero value at Pon is determined as a mean value in an interval from Pon -20ms to Pon inclusive. The duration of the Q, R, S, R' and S' waves are given in milliseconds (rounded to 2ms). The amplitudes are given in mV (rounded to 0.01mV)

Parameter	Description	Measurement unit
P	amplitude of P wave	mV
Q	amplitude of Q wave	mV
Qd	duration of Q wave	ms
R	amplitude of R wave	mV
Rd	duration of R wave	ms
S	amplitude of S wave	mV
Sd	duration of S wave	ms
R'	amplitude of R' wave	mV
R'd	duration of R' wave	ms
S'	amplitude of S' wave	mV
S'd	duration of S' wave	ms
J	amplitude of J point	mV
ST	ST integral : averaged amplitude of the ST segment (from the J point to half the distance between the J-point and max. T wave)	mV
T	amplitude of the T wave	mV
T'	amplitude of the T' wave (in case of biphasic T wave)	mV

Measurements



Care & Maintenance

Care of your AT-1

The **cable** should not be exposed to excessive mechanical stress. Whenever disconnecting the leads, hold the plugs and not the cables. Store the leads in such a way as to prevent anyone stumbling over them or any damage caused by the wheels of instrument trolleys. The cable can be wiped with soapy water. Sterilization, if required, should be done with gas only and not with steam. To disinfect, wipe the cable with any standard hospital disinfectant.

The **casing** of the AT-1 should be cleaned with a soft cloth on the surface only. **Disconnect the unit before cleaning.**

Do not, under any circumstances, immerse the apparatus into a cleaning liquid or sterilize with hot water, steam, or air.

Self-test

To Initiate a self-test of the AT-1 press the following key sequence:

A table giving information for the service staff is printed.

Maintenance

At 12 monthly intervals, the unit should undergo a technical safety check. The extent of this check should include the following:

- Visual inspection of the unit and cables.
- Electrical safety tests according to IEC 601-1 and IEC 601-2-25 Clause 19
- Functional tests according to the Service Handbook.

The test results must be documented.

Replacing the Recording Paper

NOTE: Welch Allyn can only guarantee an excellent printout if Welch Allyn original chart paper or a chart paper of the same quality is used.

The recording paper must be replaced as soon as the end of the paper is indicated by a red stripe on the lower edge. After the indication first appears, there are about 8 pages left. However, we recommend that the paper be replaced immediately.

If no paper is left, the printing process is interrupted and the paper warning lamp starts to blink.

- **Push paper compartment release and lift up cover.**
- **Remove the remaining paper.**
- **Place a new paper pack into the drawer.**
- **Check that the printed (grid) side is facing upwards, and place the beginning of the paper over the guide roller.**
- **Close lid and press firmly until release catches.**
- **Press**

to transport the paper to the start position.

Trouble Shooting

Problem	***What to Check***
Unit does not switch On/ Mains Indicator Lamp is not lit	Check if mains cable is plugged in. Call your local SCHILLER dealer if problem is still present.
"Noisy" traces	CHECK ELECTRODE CONTACT. As much as possible, ensure that patient is relaxed and warm. Activate myogram filter to reduce muscle tremor. Set mains filter to 50 or 60 Hz according to local power supply.
ECG trace "wanders" away from centre	Baseline drift - check electrode contact. Activate baseline filter.
No printout	Check if paper compartment is closed tight. Check paper level. Check paper settings.

Technical Data

Technical data subject to change without notice.

Dimensions (l/w/h):	290 x 210 x 69 mm
Weight:	2.9 kg
Mains Supply:	100 to 115 / 220 to 240 VAC, 50/60 Hz
Battery:	Built-in 12 V lead-acid battery (rechargeable)
Power Consumption:	Recording: 28 VA max.
Leads:	Standard / Cabrera
Paper Speed:	5 / 25 / 50 mm/s (direct)
Sensitivity:	5 /10 / 20 mm/mV, either automatically adjusted or manually selected
Chart Paper:	Thermoreactive
	Z-folded, 90 mm wide, perforation 90 mm or
	Roll, 90 mm wide (only on certain markets)
Printing Process:	High-resolution thermal print head, 8 dots per mm
Recording Tracks:	3 channels, positioned at optimal width on 80 mm, automatic baseline adjustment
Automatic Lead Programs:	3 channel representation of 12 simultaneously acquired standard leads
Data Record:	Listing of ECG recording data
	ECG measurement results (intervals, amplitudes, electrical axes), average complexes with optional measurement reference markings.

ECG Storage:	Circular input memory for 10 s, 12-lead ECG.	
Frequency Range of Digital Recorder		
	0 to 150 Hz (IEC); 0 to 150 Hz (AHA)	
ECG Amplifier:	Simultaneous, synchronous registration of all	
	9 active electrode signals (= 12 standard leads)	
	Sampling frequency:	1000 Hz
	Digital resolution:	5 µV
	Dynamic range:	±10 mVAC
	Max. electrode potential:	±300 mVDC
	Time constant:	>3.2 s
	Frequency response:	0.05 to 150 Hz (-3 dB)
	Input impedance:	>10 MOhms
Myogram Filter (muscle tremor filter):		
	25 Hz or 35 Hz, programmable (not active on averaged waveform). The stored ECGs can be printed with or without filter.	
Line Frequency Filter:	Distortion-free suppression of superimposed 50 or 60 Hz sinusoidal interferences by means of an adaptive digital filter.	
Patient Input:	Fully floating and isolated, defibrillation protected	
Patient Leakage Current:	<5 µA	

Technical Data

Safety Standard:	CF according to IEC and complying with the following
	RL 93/42/EEC
	EN 60601-1:1990
	IEC 601-1
	IEC 601-2-25:1993
	pr EN 1441:1994
EMC:	CISPR 11: 1985, EN 55011: 1992
	IEC 801-2: 1991
	IEC 801-3: 1984
	IEC 801-4: 1988
	IEC 801-5:
Safety Class:	I according to IEC 601-1 (with internal power supply)
	IIa according to RL 93/42/EEC, CE-0124
	This device is not designed for outdoor use (IP 20)
Environmental Conditions:	Temperature, Operating: 10^{O} to 40^{O}C
	Temperature, Storage: -10^{O} to 50^{O} C
	Relative humidity: 25 to 95% (non condensing)
	Atmospheric pressure: 700 to 1060 hPa
Control Panel:	Rubber keys